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# **Alternative Fuels and Tennessee**

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## **State Alternative Fuels Work Group Report**

**DRAFT**

January 10, 2006

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### Executive Summary

On November 23, 2005, Commissioners Davis, Kisber, Fyke, Givens and Nicely asked that a “work group” from within their respective departments produce a limited and focused report on alternative fuels in Tennessee, especially biodiesel and ethanol (biofuels). The report summarizes the current status of biofuels production, distribution and use; identifies principal advantages and issues; and recommends future state actions that would support biofuels in Tennessee.

Increasing the production, distribution and use of biofuels in Tennessee gives our state the ability to transform energy and environmental challenges into economic opportunity, improved quality of life and greater national energy security. Nurturing the growth of biofuels in Tennessee will help the state become a leader in the use of cleaner, renewable energy resources.

Biofuels have great potential to produce an array of benefits to the state and its citizens. In considering the development of biofuels as a matter of public policy, the commissioners believe that the state should provide proactive support to Tennessee’s emerging alternative fuels market. This support would help:

- Develop the infrastructure needed to establish the state’s alternative energy capability;
- Stimulate economic growth in rural counties;
- Lessen the cumulative health and economic burdens caused by mobile source emissions, particularly in counties that are designated as exceeding federal air quality standards for ozone and particulate matter; and
- Reduce our nation’s dependence on imported petroleum and our vulnerability to future fuel shortages and supply disruptions.

### Biodiesel and Ethanol

Biodiesel and ethanol are the two alternative fuels with the greatest potential for Tennessee. Pure *biodiesel* is a non-toxic, biodegradable, renewable fuel. The most important production source for biodiesel in Tennessee is **soybeans**. Pure *ethanol* is a water soluble, biodegradable, renewable fuel produced by fermenting organic materials. Currently, the most important source for ethanol in Tennessee is **corn**.

Biodiesel and ethanol are usually blended with petroleum diesel and conventional gasoline. The blends typically used and that generate the greatest benefits for the state are B20 (20 percent biodiesel and 80 percent petroleum diesel) and E85 (85 percent ethanol and 15 percent gasoline).

### Current Status of Biofuels and Crop Feedstock in Tennessee

The maps in Figure 1 show the current status of biofuel production facilities and use of biofuels in the state. Figure 2 depicts the regional distribution of corn and soybean crops in the state.

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### Principal Advantages of B20 and E85

#### *Economy*

- Construction and operation of biofuel production facilities would have significant economic impact in rural counties. The capital investment, for example, of a 13-million-gallon biodiesel production facility using soybean oil is approximately \$18.8 million.
- In 2004, Tennessee farmers cultivated approximately 1.2 million acres of soybeans with a yield of 48.4 million bushels and 615,000 acres of corn with a yield of 86.1 million bushels. Increased demand for biofuels could increase corn prices by as much as \$0.20 per bushel and soybean prices by \$0.35 per bushel.
- The federal Energy Policy Act of 2005 increases the requirements for renewable fuels in the U.S. fuel supply. Increasing in-state biofuels production will allow Tennessee to capture a share of this growing market as federal renewable fuel requirements take effect.

#### *Energy*

- Local production of fuels using domestic crops and other raw materials as feedstock reduces our dependence on imported oil.
- Increased production and use of biofuels will increase the state's ability to withstand future fuel supply disruptions and spikes in fuel prices.

#### *Public Health*

- Seventeen Tennessee counties are designated nonattainment for ozone and six are designated nonattainment for particulate matter. More than half of the state's population lives in these areas. Mobile sources are significant sources of air pollution.
- Biofuels represent an important and feasible strategy for reducing harmful emissions from mobile sources. Both E85 and B20 reduce emissions of most mobile source air pollutants.
- Biodiesel use reduces emissions of particulates and toxic substances and can thereby significantly reduce health risks to sensitive populations (e.g., children on school buses).

### Principal Issues

*ASTM Fuel Standards for B20.* ASTM International, the industry organization that defines the consensus on fuels, has not yet finalized a specific standard for B20. An ASTM standard for B20 is needed to provide assurance of fuel quality and stability and encourage engine manufacturer support for biodiesel.

*Biodiesel and Engine Warranties.* All diesel engine companies warrant the engines they manufacture. Engine manufacturers do not warrant any fuel—biodiesel or petroleum diesel. If a fuel causes engine problems, the fuel supplier is responsible. All major engine manufacturers accept the use of biodiesel that meets ASTM specifications in blends up to B5, and some have formally endorsed the use of blends up to B20. Many fleets across the nation have used biodiesel for years without experiencing warranty problems. The key is ensuring fuel quality.

*Limited Tennessee Biofuels Production.* There are relatively few ethanol and biodiesel production facilities in Tennessee. Most biofuels consumed in the state are imported from other states, and transportation costs are a significant component of the higher cost of using biofuels.

*Inadequate Storage and Blending Infrastructure.* Establishing storage and blending infrastructure at bulk terminals would allow fuel suppliers to load tankers with pre-blended E85 and B20, and avoid the current inefficient practice of traveling out of state to pick up biofuels for blending. This would lower barriers to fuel suppliers that wish to distribute biofuels, while the increased efficiency would reduce fuel-handling costs and make it easier to ensure fuel quality.

*Lack of Retail Stations.* There are relatively few retail fuel stations in Tennessee offering E85 and B20 for sale to the general public. A few stations (primarily in East Tennessee) sell B20, but only two stations in Tennessee sell E85. Executive branch government agencies own more than 1,500 flexible fuel vehicles that are capable of using E85.

*Higher Cost of Biofuels.* The prices of B20 and E85 compared to petroleum diesel and gasoline vary a great deal depending on the markets for the different fuels. In mid-December, retail prices for B20 in the Knoxville region ranged from \$0.02 - \$0.10 per gallon higher. Biofuel prices under the state contract are somewhat higher than wholesale petroleum diesel or gasoline prices (currently about \$0.35 more per gallon for B20 and about \$0.42 more per gallon for E85). More in-state biofuel production would help reduce the cost of transporting biofuels.

*Public Awareness.* Many consumers have little or no awareness of alternative fuels and potential biofuel users often have negative attitudes about biofuels based on misinformation. Owners of flexible fuel vehicles are often unaware that they could use E85 as their vehicle fuel.

### **Ongoing State Agency Alternative Fuels Activities**

#### *Department of Agriculture*

- Recruiting and supporting development of biofuels production facilities across the state
- Participating actively in establishing fuel quality standards for B20

#### *Department of Economic and Community Development*

- Supporting Clean Cities Coalitions and alternative fuels (> \$800,000 across state)
- Providing financial assistance to help local governments with biodiesel (\$1.1 million)
- Recruiting biofuels production facilities in the state

#### *Department of Environment and Conservation*

- Promoting alternative fuel use for improved air quality
- Participating in regional efforts to develop alternative fuel corridors and hosted 2005 Southeast Regional Biofuels Workshop
- Working to reduce emissions from diesel engines (alternative fuels is a strategy)
- Establishing regulatory guidance for underground storage of biofuels

#### *Department of General Services*

- Purchasing flexible fuel vehicles for state fleet (currently 810 FFVs)
- Encouraging state vehicle use of E85

#### *Department of Transportation*

- Offering financial assistance for retail outlets selling B20 and/or E85 (CMAQ funds and Public Chapter 370)
- Purchasing FFVs for TDOT fleet (currently 718 FFVs)
- Conducting pilot program using B20 in all on-road diesels in Knoxville and Johnson City
- Participating in regional efforts to develop alternative fuel corridors

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### Example Alternative Fuel Initiatives in Other States

#### *North Carolina*

- Mandates 20 percent reduction of petroleum products consumed in state fleets by 2010
- Provides a tax credit for construction, purchase or lease of renewable energy property up to 35 percent of the value of the property
- Provides a tax credit up to 25 percent of the cost for constructing and equipping biofuels production or processing facilities, and a 15 percent tax credit for construction of biofuel refueling facilities
- Offers grants for the incremental cost of purchasing or converting alternative fuel vehicles and constructing or implementing alternative fuel public refueling facilities
- NCDOT runs 22 state B20 fueling stations and used 2.5 million gallons of B20 in 2005

#### *Iowa*

- Provides financial incentives for installing or converting E85 refueling infrastructure and establishing terminal facilities to store biodiesel (\$325,000 annually for 2005 - 2008)
- Offers zero-percent loans for up to half the cost of biomass or alternative fuel production projects (maximum \$250,000) from the Alternate Energy Revolving Loan Program
- Sets E85 sales tax rate at \$0.17 per gallon (conventional gasoline tax, \$0.203 per gallon)
- Requires all state agency non-law enforcement, light-duty vehicles procured by 2010 to be alternative fuel vehicles or hybrid-electric vehicles
- Requires all state bulk diesel fuel purchases to contain at least 5 percent renewable content by 2007, rising to 20 percent renewable content by 2010

#### *Missouri*

- Directs Missouri DOT to fuel at least 75 percent of diesel vehicles and heavy-duty equipment with B20, unless B20 is \$0.25 per gallon or more higher than petroleum diesel
- Provides incentive grants to Missouri agricultural producers to promote in-state biofuels production: \$0.30 per gallon for biodiesel up to 15 million gallons; and \$0.20 per gallon for ethanol up to the first 12.5 million gallons of production, and \$0.05 per gallon for the next 12.5 million gallons

*New York*—A November 2005 executive order requires that all state agencies increase the purchase and use of biofuels for heating facilities and fueling vehicles. The order mandates that biodiesel must supply 2 percent of the fuel used in the state fleet by 2007, increasing to 10 percent by 2012.

*New Mexico*—a September 2005 executive order requires all cabinet-level state agencies, public schools and institutions of higher education to meet 15 percent of their transportation fuel needs with ethanol or biodiesel by 2010.

*Minnesota*—a 2002 Minnesota law requires that nearly all diesel fuel sold in the state must contain at least 2 percent biodiesel (B2). The law took effect on September 29, 2005, but was suspended temporarily in December after complaints of clogged fuel filters. The state believes the problem may stem from fuel that does not meet ASTM specifications. Minnesota is the largest producer of biodiesel in the nation.



## Recommendations for State Action

The goals of these recommended actions are to:

- 1) Establish biofuels production capacity and improve biofuels infrastructure,
- 2) Support the state's farmers and agricultural businesses,
- 3) Enhance the state's energy security, and
- 4) Protect public health and the environment.

**The governor should direct state agencies to focus their efforts regarding alternative fuels, to include the following provisions:**

- The Department of Agriculture should establish interim standards for B20 blends of biodiesel that will serve until a national B20 standard is finalized.
- The Departments of Economic and Community Development and Agriculture should work together in a partnership to make alternative fuels production capacity and infrastructure an economic development priority.
- State departments (TDOT, TDEC, Corrections and Mental Health) should continue supporting the development of biofuel refueling infrastructure at retail stations and/or strategically located state-owned sites with available federal or other funds.
- The Departments of Agriculture, Economic and Community Development, Environment and Conservation and Transportation should work together to develop a comprehensive, statewide public education and outreach campaign on biofuels.
- The Commissioners of Agriculture, Economic and Community Development, Environment and Conservation, General Services, Health and Transportation should lead an interagency working group to develop a comprehensive state alternative fuels strategy with the input of appropriate stakeholders. A goal of this working group is to make Tennessee a leader in the production, distribution and use of biofuels in the Southeast.

Figure 1

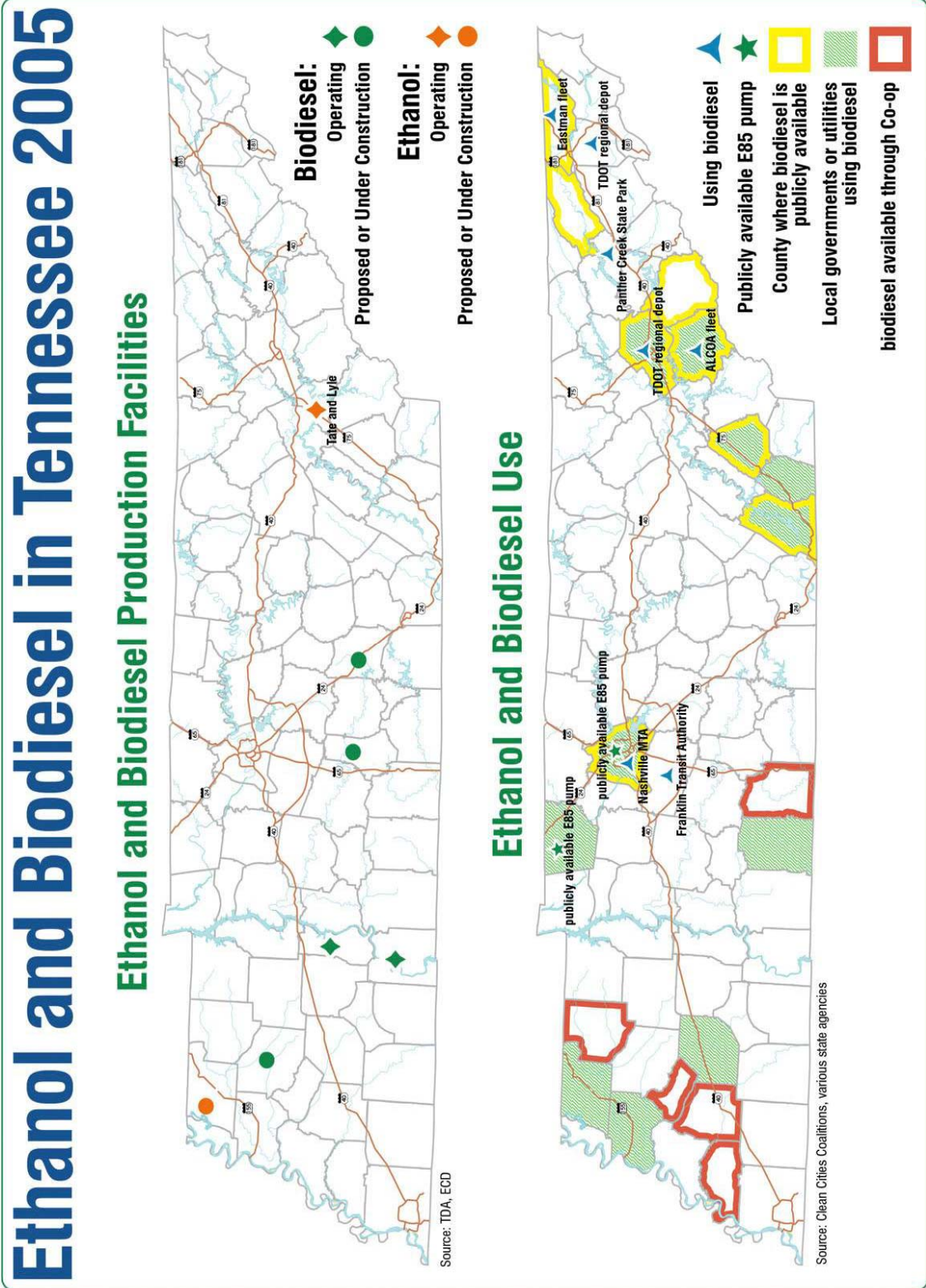
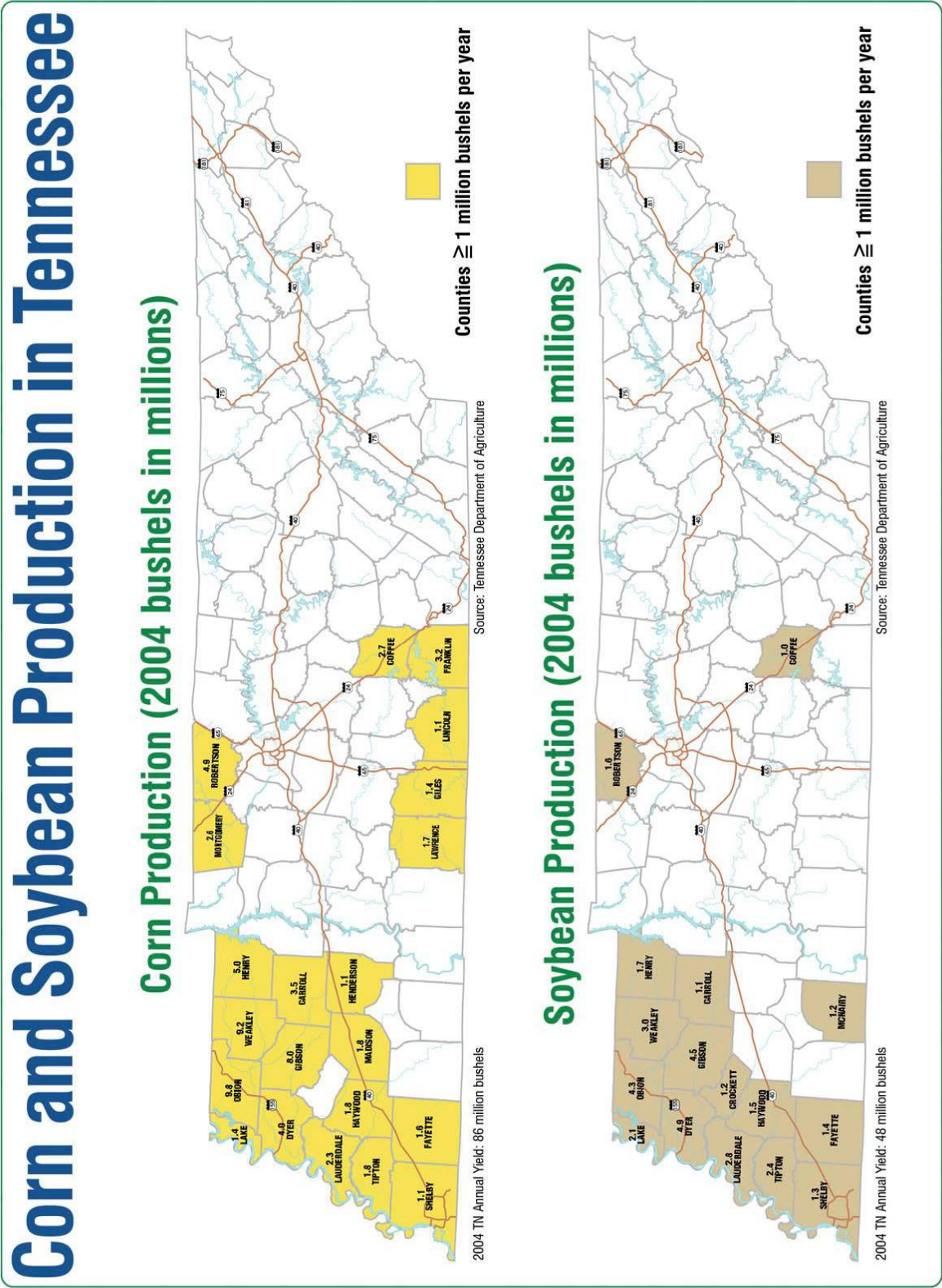


Figure 2



# Alternative Fuels and Tennessee

## State Alternative Fuels Work Group Report

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### I. Introduction

On November 23, 2005, the commissioners of the departments of Agriculture, Economic and Community Development, Environment and Conservation, General Services and Transportation requested that an interagency alternative fuels work group (the “Work Group”) prepare a summary of 1) current state activities with respect to alternative fuels, 2) related issues and 3) recommendations for a statewide alternative fuels initiative. This report presents the Work Group’s summary and recommendations.

The use of alternative fuels presents a broad range of benefits as well as opportunities for the state of Tennessee. In preparing this report, the Work Group considered the current and anticipated use of alternative fuels in Tennessee, as well as potential benefits to the state and barriers to expanded use of these fuels.

The Work Group determined that, among all alternative fuels, biodiesel and ethanol present the fewest barriers to widespread adoption and demonstrate the greatest potential for economic opportunity and use across the state. Although there are many applications for alternative fuels, this report focuses on the use of biodiesel and ethanol in the transportation sector.

### II. Background

Executive Order 11, signed by Governor Bredesen in July 2003, charged the commissioners of several state agencies to “partner with local governments and the business community to achieve new federal air quality standards while also supporting job creation efforts and building and maintaining a strong, vibrant economy.” The commissioners identified ongoing and potential actions to reduce vehicle emissions from state fleets, as well as state government actions that would assist local efforts to address mobile source issues through cleaner fuels and vehicles.

Public Chapter (PC) 891, passed by the Tennessee General Assembly in 2004, directed the Comptroller of the Treasury to prepare a report that reviews the use of alternative fuels as a means to enhance consumption of Tennessee agricultural products. PC 891 also directed the Comptroller to provide recommendations to encourage the production and distribution of biodiesel and ethanol. The Comptroller’s report, *Ethanol and Biodiesel: Questions and Answers*, was issued in March 2005.

In 2005, the Tennessee General Assembly passed two resolutions that support renewable energy—

- Senate Joint Resolution 251 urges government and private industry to pursue renewable energy sources. The resolution recognizes that production and use of renewable fuels are important to the agricultural community and to the state’s environment and that renewable energy sources will help reduce the state’s dependency on imported energy sources and on energy sources that may harm the environment.

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- House Joint Resolution 92 also recognizes the importance of developing clean, domestic energy sources and reducing dependence on foreign energy sources. The resolution urges state agencies to examine domestic and alternative energy sources and energy conservation in an effort to improve state government energy use and reduce energy costs.

On July 24, 2001, Executive Order 27 established the Governor's Interagency Energy Policy Work Group and Advisory Committee. The work group, consisting of representatives of state agencies, prepared a January 2002 report that contained a set of policy recommendations on the following energy topics: reliability, availability, quality, price and environmental effects; energy efficiency; transportation; new technologies and clean power alternatives; public education and information; and energy emergency planning. The report, adopted as state energy policy in May 2002, is accessible from the Department of Economic and Community Development website.

### III. What Are Alternative Fuels?

Alternative fuels are vehicle fuels that can be used in place of conventional gasoline or diesel. The alternative fuels most widely used in the U.S. include electricity, ethanol, biodiesel, propane and natural gas. Biodiesel and ethanol, the most commonly used renewable alternative fuels, are made from organic sources and are often referred to as *biofuels*. Both biodiesel and ethanol can be blended with conventional fuels and can be used in many existing vehicles with little or no modification.

Pure **biodiesel** is a non-toxic, biodegradable, renewable fuel produced from organic feedstock such as soybeans, used cooking oil and animal fats. In some applications, biodiesel can be used in its pure form (B100), or it can be blended at any ratio with petroleum diesel. It is often used as B20—a blend of 20 percent biodiesel and 80 percent petroleum diesel. Blends up to 20 percent can be used in almost all diesel engines without modification. Much of the existing infrastructure for storing, transporting and dispensing diesel can be used for biodiesel with little or no modification.

Pure **ethanol** is a water-soluble, biodegradable, renewable fuel produced by fermenting organic materials such as corn, grains, crop waste materials and forestry waste materials. Ethanol can be blended with gasoline at different levels. E85 (85 percent ethanol/15 percent gasoline) is an accepted alternative fuel for light-duty vehicles that are manufactured and marketed as flexible fuel vehicles. Flexible fuel vehicles (FFVs) are designed to run on any blend of gasoline and ethanol up to 85 percent ethanol. All major domestic auto makers offer E85-compatible vehicles at prices comparable to similar gasoline-powered vehicles. Because of ethanol's corrosive nature, the infrastructure to store, transport and dispense ethanol must be alcohol compatible.

### IV. Advantages of Biofuels

#### A. Fuel Qualities

Biodiesel possesses excellent lubrication qualities and could be considered as an option for restoring lubricity in ultra low sulfur diesel fuel (ULSD). New federal fuel standards, which become effective in 2006, reduce the allowable sulfur content of on-road diesel fuel from a maximum of 500 parts per million (ppm) per volume weight to less than 15 ppm. The process used to remove sulfur and aromatics from ULSD can lead to poor lubricity in diesel fuels.



Biodiesel in as little as a 1 percent to 2 percent blend restores lubricity to ULSD fuel, improving engine performance and reducing engine wear and tear.<sup>i</sup>

Pure (or neat) biodiesel (B100) contains little or no sulfur. Biodiesel blended with petroleum diesel further reduces the total sulfur content of the blended fuel.

Biodiesel has the most favorable energy balance of any transportation fuel. For every unit of energy needed to produce a gallon of pure biodiesel, 3.2 units of energy are gained. For ethanol, the net energy balance from corn grain is 1.34. For every unit of energy that goes into growing corn and turning it into ethanol, we get back about one-third more energy as automotive fuel.<sup>ii</sup>

### *B. Rural Economic Development*

Alternative fuels, especially biofuels, have great potential to produce an array of benefits to the state and its citizens. One of the most attractive benefits of biofuels is the fact that these domestic, renewable fuels can be produced in Tennessee. Fostering biofuels in Tennessee is one strategy the state can use to compete in the economy of the future and stimulate rural economic development.

The National Biodiesel Board (NBB) estimates national biodiesel production (B100) for 2005 at 75 million gallons, up from 25 million gallons in 2004. The NBB also expects the capacity to produce biodiesel to increase by at least 100 million gallons between May 2005 and May 2006. As the national market expands for these cleaner, homegrown, renewable fuels, Tennessee has an opportunity to capture a share of the growing market and thereby generate economic benefits for Tennessee communities.

Construction and operation of biofuel production facilities would have significant economic impact in rural counties. A 2003 Agri-Industry Modeling and Analysis Group report, entitled *Economic Feasibility of Producing Biodiesel in Tennessee* (the *Feasibility Report*), estimates that the construction cost a 13-million-gallon biodiesel plant would be about \$18.8 million for a stand-alone facility. For an integrated facility that would incorporate crushing of soybeans into soybean oil, the project costs would be about \$37.6 million.<sup>iii</sup>

Currently, there are no soybean crushing facilities located in the state. The Work Group has identified the need for an in-state soybean crushing/extraction facility as an important economic development objective for the state.

### *C. Farm Income*

Crop production statistics for 2004 from the Tennessee Department of Agriculture show that Tennessee farmers cultivated approximately 1.2 million acres of soybeans with a yield of 48.38 million bushels. Additionally, Tennessee farmers dedicated some 615,000 acres to corn crops with a yield of 86.1 million bushels. Figure 2 (page ix) shows counties with the greatest corn and soybean yields in the state.

Local biofuels production would add value to Tennessee crop production, increasing market share and demand for Tennessee crops, particularly corn and soybeans. For example, a 13-million-gallon biodiesel production facility would require 12.9 million gallons of soybean oil (approximately 9 million bushels of soybeans), which could be grown locally.<sup>iv</sup>

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The Department of Agriculture's Agribusiness Development Program estimates that a planned soy biodiesel production facility in Marshall County would have a positive impact on the state's soybean farmers. At full production, this plant anticipates an annual production of 140 million gallons of biodiesel. Market demand for soybean oil could increase state soybean prices by \$.35 per bushel. Based on the average yield per acre, a 1,200-acre row crop farm could realize an annual increase of nearly \$17,000 in net farm income.

The Department of Agriculture estimates that a proposed ethanol production plant in Obion County potentially could increase corn prices by \$.20 per bushel. Considering the average annual yield in the nine counties in the northwestern region of the state, this proposed ethanol plant could increase annual farm income by more than \$7 million.

### *D. Valuable Agricultural Co-products*

The use of soybeans in the manufacturing of biodiesel produces soybean meal and glycerin as valuable co-products. Soybean meal is highly regarded as the primary protein source of feed rations. Highly refined glycerin is used in cosmetics, pharmaceuticals and foods.

The ethanol production process creates distillers grains and carbon dioxide. Distillers grain is an excellent, economical feed ingredient for livestock and poultry feeds. Carbon dioxide is used in soft drink manufacturing and in the refrigeration-freezing process of food products.

Both soybean meal and distillers grains are used widely in Tennessee as feed ingredients, especially in the state's poultry and dairy industries. According to the Renewable Fuels Association, one bushel of corn will produce approximately 2.8 gallons of ethanol and 17 pounds of distillers grains. Similarly, a bushel of soybeans will produce 1.4 gallons of biodiesel and 44 pounds of soybean meal.

### *E. Energy Security*

Renewable fuels such as ethanol and biodiesel will not replace petroleum as a fuel source, but they can provide a significant impact on reducing dependence on imported oil and improving our energy security. The U.S. currently imports petroleum to meet about 60 percent of its needs; by 2025, oil imports are expected to increase to 73 percent.<sup>v</sup> The total U.S. petroleum demand in 2006 is projected to average 21 million barrels per day, up 1.7 percent from the 2005 level. Additional growth in demand of 1.9 percent is anticipated for 2007.<sup>vi</sup> In Tennessee alone, more than 1.1 billion gallons of No. 2 diesel (low-sulfur on-road and high-sulfur off-road) fuel and 3.2 billion gallons of gasoline were delivered for sale during 2004.<sup>vii</sup>

The effects of Hurricanes Katrina and Rita in 2005 highlight our dependence on petroleum as well as our vulnerability to oil price fluctuations. The southeastern region relies heavily on refineries in the Gulf Coast to supply its petroleum fuel. The fierce storms shut down 30 percent of refinery capacity in the Gulf, reduced oil production by 33 percent and restricted the ability of petroleum pipelines to transport fuel supplies. These significant reductions in production and refinery capacity, coupled with pipeline transmission problems, resulted in temporary supply shortages in some areas and in sharp spikes in gasoline and diesel prices both in Tennessee and in other southeastern states.

Public power producers often employ diesel engines for distributed energy generation and are also affected by the availability and cost of petroleum fuels. Stationary diesel engines are

desirable because of their low cost, availability and high efficiency; however, they can be a significant source of air pollution. Biodiesel is becoming a more viable option for use in stationary generators, reducing air pollution and providing a local, renewable fuel source. A collaborative pilot project in Warren County involving McMinnville Electric System, DOE, the Tennessee Valley Authority, and EmeraChem LLC is demonstrating the use of biodiesel in a stationary generator equipped with state-of-the-art emissions control in a grid-connected power service. This is the first municipal electric system in the nation to generate electricity using biodiesel.<sup>viii</sup>

### *F. Public Health and the Environment*

Mobile sources (cars, SUVs, trucks, barges, trains and construction equipment) are significant sources of the air pollutants that contribute to the formation of ground-level ozone and fine particle pollution (particulate matter). Mobile sources also emit a number of toxic chemicals, some of which are known or suspected carcinogens. Mobile source pollutants are associated with both long-term and short-term health effects, such as heart problems, asthma symptoms, eye and lung irritation, cancer and premature death.

Seventeen Tennessee counties are listed as nonattainment for the federal 8-hour ozone National Ambient Air Quality Standard (NAAQS). A designation of nonattainment means that an area is either measuring nonattainment for, or has been determined to significantly contribute to, the nonattainment of another county. Additionally, six counties are listed as nonattainment for the fine particulate matter NAAQS. Often referred to as soot, these microscopic particles are less than 2.5 microns in size—about 1/30<sup>th</sup> the width of a human hair—and can be breathed deeply into the lungs. More than half of the state's population lives in these federally designated nonattainment areas.

### Biodiesel

Studies conducted by the U.S. Environmental Protection Agency (EPA) and the DOE National Renewable Energy Laboratory show that use of biodiesel in B20 or higher blends results in significantly lower emissions of particulate matter, carbon monoxide, toxic contaminants, sulfur dioxide and hydrocarbons, as well as visible smoke and noxious odors as compared to petroleum diesel. EPA accepts the use of B20 as an EPA-verified technology for reducing emissions from diesel engines.

Estimates of the air quality benefits of biodiesel vary based on a number of factors, such as age and type of engine, type of vehicle and how it is used, biodiesel feedstock and the sulfur content of the base petroleum diesel fuel. Table 1 provides EPA estimates of the average expected emission reductions for 100 percent biodiesel and a 20 percent blend of biodiesel as compared to petroleum diesel (on-road fuel). The emission benefits of blends under 20 percent are reduced somewhat proportionally to the amount of biodiesel contained in the blend.

Some studies have indicated that a 20 percent blend of biodiesel may increase NO<sub>x</sub> emissions by about two percent. Studies are continuing to better determine the effects of biodiesel on vehicle emissions. For example, test results from the 2004 Nashville Metropolitan Transit Authority bus demonstration using B20 with a NO<sub>x</sub>-reducing additive showed a 9 percent decrease in NO<sub>x</sub> emissions for on-road use and an approximate 20 percent decrease in NO<sub>x</sub> for in-city use. Verified real-time, in-use, on-road emissions data from a 2005 study of heavy-duty dump trucks



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in the North Carolina Department of Transportation showed average nitrogen oxide reductions of 10 percent using B20 without a NOx-reducing additive.

**Table 1**

<b>Pollution Reductions Biodiesel vs. Petroleum Diesel</b>		
<b>Pollutant</b>	<b>B100</b>	<b>B20</b>
Carbon monoxide (CO)	-50%	-10%
Particulate matter (PM)	-70%	-15%
Hydrocarbons (HC)	-40%	-10%
Sulfur oxides (SOx)	-100%	-20%
Nitrogen oxides (NOx)	+ 9%	+ 2%
Source: U.S. Environmental Protection Agency		

### Ethanol

Flexible fuel vehicles running on ethanol in an E85 blend emit less carbon monoxide and other toxic chemicals than those burning conventional gasoline. The chart below provides EPA estimates of the average expected emission reductions for E85 in FFVs as compared to conventional gasoline.

**Table 2**

<b>Pollution Reductions E85 vs. Conventional Gasoline</b>	
<b>Pollutant</b>	<b>Reductions</b>
Carbon monoxide (CO)	-40%
Particulate matter (PM)	-20%
Volatile organic compounds (VOC)	-15%
Sulfates	-80%
Nitrogen oxides (NOx)	-10%
Source: U.S. Environmental Protection Agency	

There is a growing trend to blend up to 10 percent ethanol into all grades of gasoline, and blends up to 10 percent can be used in most cars and gasoline-powered trucks as a premium high-octane gasoline. EPA and DOE do not consider low ethanol blends (10 percent ethanol/90 percent gasoline) as an alternative fuel. Studies show that the air quality benefits from ethanol in low blends are questionable due to increased volatility in both the fuel and in evaporative emissions from vehicles.<sup>ix</sup> Evaporative emissions occur when a liquid fuel evaporates and fuel molecules escape into the atmosphere. A considerable amount of hydrocarbon pollution results from evaporative emissions that occur when fuel leaks or spills, or when fuel gets hot and evaporates from the fuel tank or engine.

## **V. Status of Alternative Fuels in Tennessee**

Interest in biofuels in Tennessee is increasing steadily. Figure 1 (page viii) indicates current and proposed biofuels production facilities. The volume of biofuels produced in the state is small, although several companies have expressed interest in developing production capability for ethanol or biodiesel, including a waste-to-ethanol process. It is interesting to note that most of

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the biofuels produced in the state are shipped out of state, while most of the biofuels consumed in the state are imported.

Figure 1 also indicates locations of publicly accessible biofuel refueling stations across the state. The Tennessee Farmers Cooperative Association is a strong supporter of biofuels, and more than 40 farmer co-ops across the state sell some blend of biodiesel (primarily B2 and B5 blends). A few of these locations may be the only outlet for biodiesel in a given area.

### Tennessee BioFacts

**Biodiesel usage in 2005:** approximately 1 million gallons of B100  
Biodiesel production capacity: approximately 1.6 million gallons B100 per year  
Retail biodiesel refueling sites: 18 (13 sites offer B20)

**Ethanol usage in 2005:** approximately 180,000 gallons of E85  
Ethanol production capacity: 67 million gallons E100 per year  
Retail E85 refueling sites: 2  
Estimated number of FFVs in U.S.: 4.3 million  
(through model year 2004)

**Retail refueling sites selling E10:** 48 (all in East Tennessee)

**Table 3: Tennessee Biofuels Production and Capacity**

Ethanol	Current Production	Production Capacity	Planned Production
*Tate and Lyle, Loudon County	67 mgy	67 mgy	Seeking expansion
Ethanol Grain Processors, Obion County	Proposed	40 to 50 mgy	40 to 50 mgy
<b>Biodiesel</b>			
*NuOil, Inc., Hardin County	< 1.5 mgy	N/A	
Biofuels of TN, Decatur County	100,000 gy	N/A	
AgriEnergy Management (AEM), Marshall Co.	Proposed	140 mgy	5 to 7 mgy initially
Tennessee BioEnergy, Coffee Co.	Proposed		3.5 mgy
Mean Green Biodiesel of TN, Gibson County	Proposed	32 mgy	32 mgy

\*Company ships most fuel out of state

Source: Tennessee Department of Agriculture and Clean Cities Coalitions

## VI. State Agency Alternative Fuels Activities

Tennessee state agencies have been involved in promoting and using alternative fuels on a local, statewide and/or regional basis for the past several years. Some of the state agency actions are listed below. More detailed summaries are contained in Appendix A.

- The Department of Agriculture works to recruit the development of biofuels production facilities across the state and participates actively in the establishment of a national fuel quality standard for low blends of biodiesel, especially for B20.
- The Department of Economic and Community Development's State Energy Office has been a major force in the development of Tennessee's three Clean Cities Coalitions. Nearly \$2 million has been committed to alternative fuels in Tennessee through the State Energy Office, including a biodiesel infrastructure grant program to assist county fleets (especially school buses) in using biodiesel.

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- The Department of Environment and Conservation promotes alternative fuel use to protect public health and the environment, especially in conjunction with local governments in air quality nonattainment areas. TDEC and TDOT participate actively in a regional effort to expand the use of alternative fuels, and TDEC hosted a Regional Biofuels Workshop in 2005. The Division of Underground Storage Tanks has developed guidance to assist tank owners with the conversion or installation of underground storage tanks to accommodate biofuels.
- The Department of General Services ensures that the primary state fleet meets federal alternative fuel fleet requirements. There are currently 810 flexible fuel vehicles capable of burning E85 in the Motor Vehicle Management fleet. Generally, the department exceeds the federal alternative fuel mandate by 5 percent to 10 percent to gain alternative fuel credits.
- The Department of Transportation is working to assist retail station owners with infrastructure to dispense E85 and B20. In November 2005, TDOT began using B20 in on-road diesel vehicles in Knoxville and Johnson City and hopes to expand the use of B20 in other TDOT regional facilities across the state in 2006. TDOT has purchased 718 flexible fuel vehicles, which now comprise almost 52 percent of the department's light-duty fleet. TDOT plans to obtain alternative fuel credits for use of biodiesel in its diesel fleet.

## VII. Alternative Fuel Initiatives in Other States

Across the nation, state governments are becoming more aggressive in encouraging production and use of biofuels. As noted in the Comptroller's report, *Ethanol and Biodiesel: Questions and Answers*, as of November 2004, there were 41 states that offered application incentives for the sale, distribution and use of biofuels and alternative fuel vehicles; 23 states offered production incentives, including direct payments, tax credits, grants, loans and other benefits for biofuel producers. Twenty-one states offered both application and production incentives. Tennessee does not currently offer either application or production incentives for biofuels. Tables 4 and 5 list the states that offer application and production incentives as of November 2004.

Since 2004, several state governments have taken steps to encourage the growth of biofuels production and biofuels use within their states. Among these are the states of New York and New Mexico (see Appendix B for additional information).

- An executive order issued by New York Governor Pataki in November 2005 requires that all state agencies increase their purchase and use of biofuels for heating facilities and fueling vehicles. The order mandates that biodiesel must supply 2 percent of the fuel used in the state fleet by 2007, increasing to 10 percent by 2012.
- In September 2005, New Mexico Governor Bill Richardson issued an executive order requiring all cabinet-level state agencies, public schools, and institutions of higher education to meet 15 percent of their transportation fuel needs with ethanol or biodiesel by 2010.

Other states, such as North Carolina and Iowa, offer a suite of incentives to encourage biofuels production, distribution and use. The states of Minnesota and Illinois have established market mandates.

- Except for limited special fuel applications, all gasoline sold in the state of Minnesota is required to contain 10 percent ethanol. The law also requires that nearly all diesel fuel sold in the state must contain at least 2 percent biodiesel (B2) effective September 29, 2005.

## Alternative Fuels and Tennessee

- Illinois mandates that all diesel fuel sold or offered for sale in the state for use in internal combustion engines must contain at least 2 percent biodiesel (B2) effective June 2006.

**Table 4: States with Application Incentives as of November 2004**

	Market Mandates	Fuel Tax Exemptions/ Reductions	Incentives for Distribution/ Refueling Station Installation	Incentives for Alternative Fuel Vehicle (AFV) Purchases	Incentives to Convert into AFVs	Biofuels Required for Public Fleets
Arizona				X		X
Arkansas			X	X	X	
California		X		X		
Colorado			X	X	X	
Connecticut					X	
Delaware		X				
Georgia				X	X	
Hawaii		X	X			
Idaho		X				
Illinois	X	X	X	X	X	
Indiana		X	X	X	X	
Iowa		X	X			X
Kansas			X	X	X	X
Louisiana			X	X	X	
Maine		X	X	X		
Maryland				X		X
Massachusetts						X
Minnesota	X					X
Mississippi						X
Missouri		X				X
Montana		X			X	
Nebraska		X	X	X	X	
Nevada		X				X
New Jersey			X	X	X	X
New Mexico		X		X		
New York			X	X	X	X
North Carolina		X	X	X	X	X
North Dakota		X				
Ohio				X		
Oklahoma			X	X	X	X
Oregon			X	X	X	
Pennsylvania			X	X	X	
Rhode Island		X	X	X	X	
South Carolina						X
South Dakota		X				
Texas		X		X	X	X
Utah				X	X	
Virginia			X	X		
Washington		X	X			X
West Virginia				X	X	
Wisconsin						X

Source: U.S. Department of Energy, Energy Efficiency and Renewable Energy, Clean Cities Program

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**Table 5: States with Production Incentives as of November 2004**

	Direct Producer Payments	Income Tax Credits	Tax Exemptions	Grant/Loan Programs
Arkansas	X			
Hawaii		X	X	
Indiana		X		
Iowa				X
Kansas	X			
Maine		X		
Michigan			X	
Minnesota	X			
Mississippi	X			X
Missouri	X			
Montana				X
New Mexico				X
North Carolina		X		
North Dakota	X	X	X	
Oregon				X
Rhode Island			X	
South Carolina			X	
South Dakota	X			
Texas				X
Virginia		X		
Washington			X	
Wisconsin			X	
Wyoming		X		

Source: U.S. Department of Energy, Energy Efficiency and Renewable Energy, Clean Cities Program

## VIII. Federal Biofuel Tax Incentives

The American JOBS Creation Act of 2004 (JOBS Bill) provides significant tax credits for fuel blenders to encourage the sale of ethanol and biodiesel. The Volumetric Ethanol Excise Tax Credit (VEETC) provides blenders a \$0.51 per gallon tax credit on every gallon of ethanol blended with gasoline. Furthermore, it is anticipated that the VEETC will generate more than \$3 billion per year in additional Highway Trust Fund revenue, which will improve the nation's ability to address transportation infrastructure needs.

The JOBS Bill also created a new tax credit for biodiesel: \$1 per gallon for biodiesel made from virgin oils derived from agricultural products and animal fats, and \$0.50 per gallon for biodiesel made from recycled agricultural products and animal fats. Essentially, the federal tax credit for blending virgin biodiesel is one penny per gallon for every percentage point of biodiesel blended (e.g., blending a gallon of B20 earns the blender a \$0.20 tax credit). It was the intent of Congress that these tax credits would result in lower retail prices for consumers.

The federal Energy Policy Act of 2005 sets a new national minimum requirement for the use of biofuels, particularly ethanol. The new Renewable Fuels Standard requires that fuels sold in the U.S. contain a total of 4 billion gallons of biofuels in 2006, increasing to 7.5 billion gallons in 2012. The standard provides greater flexibility for refiners by allowing renewable fuel credits and by eliminating the reformulated gasoline oxygenate standard. The bill allows a credit of 2.5 gallons for every gallon of ethanol produced from wastes or cellulosic biomass sources.<sup>x</sup>

In December 2005, the Renewable Fuels Association (RFA) announced that the U.S. ethanol industry is now producing ethanol at a rate of more than 4 billion gallons annually, based on production statistics from the U.S. Energy Information Administration. Currently, 94 ethanol

plants have a combined production capacity of more nearly 4.2 billion gallons a year. There are 30 ethanol plants and nine expansions under construction with a combined annual capacity of more than 1.5 billion gallons.<sup>xi</sup> The use of biodiesel has increased 60-fold, from 500,000 gallons in 1999 to 30 million gallons in 2005.<sup>xii</sup> There are 45 active biodiesel plants across the nation, with another 54 planned. Dedicated capacity for biodiesel production is 180 million gallons per year; production capacity is expected to increase by at least 100 million gallons by May 2006.<sup>xiii</sup>

Other provisions of the Energy Policy Act of 2005 include:

- Provides a tax credit equal to 30 percent of the cost of alternative fuel refueling equipment, up to \$30,000 in the case of large stations or \$1,000 for residences. The credit applies to fueling stations for ethanol, natural gas, compressed natural gas, liquefied petroleum gas, hydrogen and biodiesel blends containing at least 20 percent biodiesel and is effective for purchases between January 1, 2006, and December 31, 2009.
- Requires federal alternative fuel fleets with flexible fuel vehicles to use alternative fuels, provided they are reasonably available and not unreasonably expensive.
- Establishes a small producer biodiesel and ethanol credit of \$0.10 per gallon (up to 15 million gallons for annual capacity producers of up to 60 million gallons, and increases the ceiling on production capacity for small ethanol producers from 30 million gallons annually to 60 million gallons.
- Extends the excise tax provisions and income tax credits for biodiesel through 2008 and establishes a similar credit for renewable diesel (derived from biomass using thermal depolymerization processes).

## IX. Biofuels Issues and Obstacles

Advancing production, distribution and use of new non-petroleum fuels into a well-established petroleum market is difficult at best and presents many obstacles. Some of these issues and obstacles are discussed below.

### A. *ASTM Fuel Standards for B20*

The industry organization that defines the consensus on fuels is ASTM International. Formerly called the American Society for Testing and Materials, ASTM International is one of the largest voluntary standards development organizations in the world and is a trusted source for technical standards for materials, products, systems and services. ASTM fuel standards are the minimum accepted values for fuel properties to provide adequate customer satisfaction and/or protection.

In addition to standards for conventional petroleum diesel and gasoline, ASTM has developed fuel quality standards for pure biodiesel (B100) and ethanol (E100). These specifications are intended to ensure the quality of biodiesel and ethanol to be used as a blend stock in low blends (e.g., B20, E10). ASTM has also developed specifications for E85 fuel ethanol. Currently, ASTM has not finalized a specific standard for B20.

### Biodiesel Blends

As discussed in Section IV, biodiesel in a 20 percent blend (B20) offers many advantages. The Work Group has identified the lack of an ASTM standard for B20 biodiesel blend as an important obstacle to its widespread distribution and use across the state. The lack of specific

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requirements for B20 presents a challenge to the state's fuel quality regulatory program, which is administered by the Department of Agriculture, Regulatory Services Division. Regulatory program staff must assess the quality of B20 blends based on parameters established for petroleum diesel (ASTM D 975) along with those established for B100 (ASTM D 6751). A more specific set of fuel quality requirements for B20 blends would allow the regulatory program to assure that blended fuel meets fuel quality standards.

All engines are designed and manufactured for a fuel that has certain characteristics. Diesel engine and fuel injection manufacturers design their engines around ASTM D 975. Engine manufacturers are often hesitant to fully support the use of biodiesel in blends greater than 5 percent because of the lack of exact fuel quality specifications for biodiesel blends. An ASTM standard for biodiesel blends would allow manufacturers to provide their customers with a more definitive judgment on how the use of biodiesel would affect engine and fuel system operations compared to ASTM D 975 fuel.

ASTM approved a provisional standard for biodiesel in July 1999, and the full standard for biodiesel, with the new designation of D 6751, was issued in December 2001. This standard covers pure biodiesel (B100) for blending with petroleum diesel in levels up to 20 percent by volume. Higher levels of biodiesel are allowed on a case-by-case basis after discussion with the individual engine company since most of the experience in the U.S. has been with B20 blends. The approval of the B100 biodiesel standard and the technical reviews necessary to secure its approval has provided both manufacturer and customers with the information needed to assure trouble free operation with biodiesel blends.

ASTM is now working on standards for biodiesel blends through its Biodiesel Task Force. The Task Force has determined that blends up to 5 percent should meet the standard established for petroleum diesel (D 975). The work on a proposed standard for blends greater than B5 and up to B20 continues at a rapid pace within the ASTM Biodiesel Task Force, and it is possible that a standard for blends up to B20 will be approved at the June 2006 meeting. Although there are positive signs that solutions to the technical issues are being accomplished, an exact date of standards approval cannot be predicted with any certainty at this time. For this reason, coupled with the rapidly increasing use and demand for biodiesel blends, it would be prudent for the state of Tennessee to act immediately to develop emergency interim standards that will provide assurance of product integrity as well as consumer protection.

### Ethanol

The ethanol and hydrocarbon denaturant used in making fuel ethanol must meet the requirements of ASTM D 4806. This specification covers nominally anhydrous denatured fuel ethanol intended to be blended with unleaded or leaded gasoline at 1 to 10 volume percent for use as an automotive engine fuel.

The standard specification for E85 fuel ethanol is ASTM D 5798. This specification covers a fuel blend, nominally 75 to 85 volume percent denatured fuel ethanol and 25 to 15 additional volume percent hydrocarbons, for use in automobiles (spark-ignition engines).

### *B. Engine Manufacturer Warranties*

All diesel engine companies warrant the engines they manufacture for "materials and workmanship." If there is a problem with an engine part or with engine operation due to an error

in manufacturing or assembly within the prescribed warranty period, the problem would be covered by the engine company. Typically, an engine company will define what fuel the engine was designed for and will recommend the use of that fuel to their customers in owner's manuals.

Engine manufacturers do not warrant fuel—whether that fuel is biodiesel or petroleum diesel. Engine problems caused by any fuel are the responsibility of the fuel supplier and not the engine manufacturer. Any reputable fuel supplier should stand behind its products and cover any fuel quality problems that may occur. The most important aspect regarding engine warranties and biodiesel is whether an engine manufacturer will void its parts and workmanship warranty when biodiesel is used, and whether the fuel producer or marketer will stand behind its fuels should problems occur.

All major diesel engine manufacturers with equipment in North America accept the use of biodiesel that meets ASTM specifications in blends up to B5. Most major engine companies have stated formally that the use of blends up to B20 will not void their parts and materials workmanship warranties. Many fleets across the nation have used biodiesel for years without experiencing warranty problems.<sup>xiv</sup> It is believed that engine manufacturers will become more comfortable with B20 blends of biodiesel once an ASTM standard for B20 is developed. This will provide some greater assurance of biodiesel quality and stability and will provide manufacturers greater quality control in testing biodiesel blends in their engines.

Most major automobile manufacturers have developed flexible fuel vehicles (FFVs) that are capable of running on either gasoline or fuel blends up to 85 percent ethanol (E85). Burning E85 in flexible fuel vehicles does not present warranty issues since those vehicles are specifically designed to run on E85.

### *C. Underground Storage Tank Requirements*

The Department of Environment and Conservation, Division of Underground Storage Tanks, regulates all underground storage infrastructure associated with the storage and dispensing of petroleum products, including biofuel blends. The division has established guidance to assist tank owners who wish to store and dispense biofuels. This guidance includes information regarding equipment compatibility for use with biodiesel and, in particular, with ethanol. Handling of any blend of ethanol requires the use of alcohol-compatible system components in order to avoid potential problems with fuel storage and possibly fuel use. Ethanol storage and handling issues can be readily avoided by using appropriate alcohol-compatible components and by exercising diligent care in maintaining storage facilities so that water does not contaminate the stored product. Ethanol is used widely across the U.S. as E85 and in low blends. The National Ethanol Vehicle Coalition reports that there are currently 585 retail E85 stations located across the nation.

### *D. Limited Tennessee Biofuels Production*

There are few biofuel production facilities in Tennessee, although there are several planned or proposed ethanol and biodiesel facilities (see Figure 1, page viii). Most of the biofuels consumed in the state are imported from other states. Encouraging more biofuels production in the state should be a major economic development priority, which will allow Tennessee facilities to capture a portion of this rapidly growing market and bring economic development benefits to



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Tennessee communities. In addition, in-state biofuels production would reduce fuel transportation costs, lowering costs for biofuel consumers and encouraging more use.

### *E. Inadequate Biofuels Storage and Blending Infrastructure*

Biofuels sold in Tennessee today often require the fuel supplier to visit two separate bulk terminal facilities, one to pick up either gasoline or petroleum diesel and another to pick up the alternative fuel to be blended. Most likely, the biodiesel or ethanol must be picked up at an out-of-state facility. The fuel supplier typically trucks the fuels back to a facility for storage and blending. This inefficient fuel distribution system adds to the retail cost of the fuels and discourages some fuel suppliers from getting involved in the biofuels business.

Establishing on-site storage and blending infrastructure at Tennessee bulk storage terminals in major metropolitan areas would provide a significant boost to the biofuels industry in Tennessee. On-site storage and blending facilities would allow wholesale fuel distributors to load tanker trucks with E85 and B20 blended at the terminal, as well as their normal loads of gasoline and petroleum diesel. This would provide several benefits, including lowering barriers to more companies that wish to market and distribute biofuels. The increased efficiency would reduce fuel-handling costs, and state-of-the-art blending equipment would make it easier to ensure quality control of the blended fuels.

### *F. Lack of Retail Refueling Stations*

There are relatively few retail fuel stations in Tennessee offering E85 and B20 for sale to the general public. There are currently 16 retail outlets for biodiesel in East Tennessee, although some offer only low blends of biodiesel, such as B5. There are two B20 retail stations in Middle Tennessee, one in Nashville and one in Clarksville (Montgomery County). Only two stations in Tennessee sell E85, one in Nashville and one in Clarksville. Executive branch state agencies own more than 1,500 flexible fuel vehicles that are capable of using E85. These flexible fuel vehicles could potentially use 1.5 million gallons of E85 each year.

### *G. Higher Cost of Biofuels*

The relative prices of E85 and B20 compared to gasoline and petroleum diesel vary a great deal depending on the markets for the different fuels. The DOE Clean Cities September 2005 *Alternative Fuel Price Report* indicates that the price of B20 nationally is about \$0.10 per gallon higher than petroleum diesel. In mid December 2005, retail prices for B20 in the Knoxville region ranged from \$0.02 - \$0.10 per gallon higher than petroleum diesel. The same DOE price report found that E85 was about \$0.36 per gallon less than the average price of gasoline.

Fuel prices constantly change in response to supply, demand and market forces. This was clearly demonstrated in the summer of 2005 when Hurricanes Katrina and Rita in the Gulf Coast led to oil supply disruptions and extreme spikes in gasoline and diesel prices. It is notable that during this period, the prices of B20 and E85 in Tennessee were somewhat less than the prices of petroleum diesel fuel and gasoline.

Wholesale fuel prices paid by Tennessee state agencies are governed by the terms of the state fuel services contract (Fuelman). Currently, the prices of B20 and E85 paid by the state are somewhat higher than for gasoline and petroleum diesel. For the week ending January 1, 2006,

the OPIS price (wholesale price at the bulk terminal rack) for B20 was about \$0.25 per gallon more than the price of petroleum diesel. The contract cost of transporting fuel from Cincinnati to Knoxville is another \$0.11 per gallon. As a result, the state is paying about \$0.36 more per gallon for B20 than for petroleum diesel.

Prices for E85 on OPIS for that same period were about \$0.35 per gallon higher than for gasoline. The profit margin for E85 is one cent less than the margin for gasoline, and transportation costs for E85 are about \$0.08 per gallon. The result is that the state paid about \$0.42 more per gallon for E85 than gasoline. If the state could obtain E85 and B20 from nearby sources, the transportation costs per gallon would be reduced.

Transportation is a significant portion of the cost Tennesseans pay for biofuels. This potential for lower fuel costs is another major incentive to establish more in-state production of biofuels.

### *H. Lack of Public Awareness*

Many vehicle fleet managers and Tennessee citizens have little or no awareness of alternative fuels, their benefits and whether cleaner fuels may be used in their personal or company vehicles. In addition, many potential biofuel users have developed negative attitudes about biofuels based on the anecdotes they have heard. In some cases, these negative attitudes are based on misleading information or exaggerated concerns.

The DOE Alternative Fuel Data Center reports that 4.2 million flexible fuel vehicles (capable of burning either gasoline or gasoline-ethanol blends up to 85 percent ethanol) were manufactured for sale in the U.S. by the end of model year 2004. Many of these vehicle owners are not aware that they have a choice to use E85 as their vehicle fuel.

Education and outreach efforts designed to inform fleet managers and the general public about alternative fuels will be important components of any successful alternative fuel strategy. Education efforts should be designed to counter misinformation and to inform employers and citizens about these fuels; their advantages; the issues surrounding the use of biofuels; the vehicles that are capable of using these cleaner, renewable fuels; and where to obtain biofuels and/or more information.

### *I. Biofuels Data Collection*

There is currently no established mechanism for collecting consumption data on biofuels sold in the state. In order to track growth and trends in biofuels use, the state should establish a mechanism for collecting biodiesel and ethanol sales data. This information could be especially important in determining the effects of potential tax incentive programs to encourage the production, distribution and use of biofuels.

## **X. Recommendations for State Action**

The Work Group examined a range of issues related to alternative vehicle fuels in Tennessee, inventoried current state activities, considered the implications of expanded state support for alternative fuels, and assessed options for actions and initiatives that state government could take to encourage increased production and use of alternative fuels.

These recommendations for state action build upon existing alternative fuel activities and are presented as tiers of options based upon ease of implementation, beginning with activities that

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are relatively low cost and less difficult to implement. The recommendations are fashioned as an integrated package of actions and are designed to work together to move the state toward an explicit and comprehensive state alternative fuels policy. The Work Group developed these recommendations with the goals to:

- ♦ Establish biofuels production capacity and improve biofuels infrastructure
- ♦ Support Tennessee farmers and agricultural businesses
- ♦ Enhance the state's energy security
- ♦ Protect public health and the environment

**To focus state agency actions regarding alternative fuels, the governor should issue a directive to state agencies that includes the following provisions:**

- A. State government should lead by example in the use of alternative fuels. The governor's directive should include the following:
  1. Direct state agencies to use ethanol (E85) and biodiesel (B20) in appropriate state-owned vehicles whenever possible. A program should be developed to educate state employees about the use of E85 and B20 and to publicize fuel availability as new refueling sites become available.
  2. Direct the appropriate state agencies to establish a mechanism to collect data on the volume of biodiesel and ethanol (gallons of B100 and E100) sold or consumed in Tennessee. This data is necessary to help measure the success of biofuel efforts in the state.
  3. Direct state agencies to encourage the use of B20 and E85 by state contractors.
  4. Encourage private and local government fleets to use cleaner fuels, especially the use of biodiesel by school buses, transit vehicles and waste hauler fleets.
  5. Encourage support of Tennessee's three Clean Cities coalitions by becoming active, dues-paying coalition members (especially TDEC, TDOT, TDA, ECD and General Services).
- B. Establish interim state standards for B20 blends of biodiesel that will serve until a national B20 standard is finalized.

The Tennessee Department of Agriculture should take immediate action to establish fuel quality standards for B20 blends that will provide an adequate level of quality assurance until such time as ASTM International develops a consensus standard, along with a program for regulating biodiesel B20 blends at the retail and blender levels. The department should continue to participate actively in the ASTM process and promote the adoption of an ASTM B20 specification.

- C. Make alternative fuels production capacity and infrastructure an economic development priority.
  1. The departments of Economic and Community Development and Agriculture should work together to elevate the priority of biofuels production facilities and biofuels feedstock processing facilities (e.g., soybean oil extraction plant) as economic development priorities for the state. These agencies, with their recruiting expertise,

- incentive funds and agricultural knowledge, should partner to devise a strategy to develop alternative fuel processors in the state through recruitment of new companies or expansion of in-state business interests. The ability to process Tennessee-grown agricultural products into biofuels should be a major criterion of this strategy.
2. The state should explore possible funding sources to support the installation of biofuel infrastructure at bulk terminals (e.g., storage tanks and fuel blending equipment). This would allow fuel wholesalers to obtain blended E85 and B20 at the terminal rack and would significantly increase the efficiency of handling biofuels. It would also make it easier for fuel distributors to incorporate biofuels into their existing business.
- D. Encourage and support the development of biofuels refueling infrastructure across the state with available federal or other funds.
1. The Tennessee Department of Transportation (TDOT) should expand the biodiesel pilot project to all TDOT regions (Chattanooga, Jackson and Nashville).
  2. State agencies, especially TDOT, TDEC, Corrections and Mental Health, should assist in identifying additional strategically located state-owned sites for dispensing B20.
  3. The state should encourage and support the development of biofuels refueling infrastructure (fuel storage tanks and fuel pumps) with available federal or other funds in order to stimulate the proliferation of biofuels refueling stations across the state. TDOT should continue current plans to initiate such a project using funds from the federal Congestion Mitigation and Air Quality Improvement (CMAQ) program and Public Chapter 370 and evaluate the feasibility of expanding this effort.
  4. State agencies involved in the Southeast Alternative Fuels Task Force should continue working with other southeastern states to develop a regional network of interstate clean fuel corridors linking major destinations in Tennessee and neighboring states. The state should continue its participation in regional efforts to increase the availability and use of cleaner fuels in the Southeast.
- E. Establish a statewide public education and outreach campaign on biofuels.
1. The departments of Agriculture, Economic and Community Development, Environment and Conservation and Transportation should work together with Clean Cities coalitions, regional clean air coalitions, local governments and other partners to establish a comprehensive, statewide public education and outreach campaign to increase public awareness and understanding of alternative fuels, particularly biofuels. This campaign would attempt to reach both citizens and vehicle fleet managers in local governments and private sector businesses. Campaign information would include the benefits and characteristics of biofuels, the vehicles that are capable of using these fuels, refueling locations, and how to obtain more information.
  2. TDOT should work with sister states to develop and install uniform information signs along interstates and major highways to help travelers locate publicly accessible refueling locations.

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- F. Develop a comprehensive state alternative fuels strategy that will make Tennessee a leader in the production, distribution and use of biofuels in the Southeast.

The commissioners of Agriculture, Economic and Community Development, Environment and Conservation, General Services, Health and Transportation should lead an interagency working group to develop a comprehensive state alternative fuels strategy (both short- and long-range) with the input of appropriate stakeholders. A goal of this working group is to make Tennessee a leader in the production, distribution and use of biofuels in the Southeast. Recommendations for a state strategy should recognize the importance of energy security to the state's continued economic well-being and the importance of energy conservation and renewable fuels in decreasing our dependence on imported oil. A major component of the working group's report will be recommendations for initiatives or actions to encourage the production, distribution and use of biofuels in the state.

Many of the mandates and incentive programs developed by other states to encourage and promote alternative fuels have been implemented by regulatory or legislative action. A goal of this interagency working group will be to identify the most advantageous proposals dealing with such issues as tax incentives for promoting the production, distribution and use of biofuels. At a minimum, the issues that the work group will address include the following:

1. A requirement that all diesel fuel sold in the state be mixed with two percent biodiesel (B2). The state of Minnesota implemented such a law in September 2005.
2. Financial incentives for establishing in-state biofuels production.
3. Programs to cost-share retail infrastructure costs.
4. Financial incentives or cost-share programs to assist in the development of fuel distribution infrastructure, such as railroad spurs, terminal storage for ethanol and B100, blending equipment, etc.
5. Programs, including tax incentives, to make biofuels generally available to the public at prices comparable to traditional fuels.
6. Initiatives to encourage fuel blenders to use federal tax credits for blenders to lower fuel prices for consumers.
7. Programs to help pay any additional costs of using B20 for school buses, transit agencies and government waste hauler fleets.

Critical stakeholders include the many Tennessee entities that have an interest in alternative fuels and transportation issues, including:

- ♦ Clean Cities Coalitions
- ♦ Local air quality agencies (Memphis, Nashville, Knoxville, Chattanooga)
- ♦ Local governments
- ♦ Transit agencies
- ♦ Federal government agencies located in Tennessee
- ♦ Power companies and alternative fuel providers
- ♦ Farmers and the agricultural community
- ♦ Fleet operators and managers
- ♦ Petroleum fuel wholesalers, distributors and retailers

- ♦ Regional clean air coalitions
- ♦ Environmental community
- ♦ General public
- ♦ Tennessee Valley Authority
- ♦ Oak Ridge National Laboratory
- ♦ University of Tennessee-Knoxville, Energy and Environment Resource Center
- ♦ University of Tennessee, Center for Profitable Agriculture

### **XI. Appendices**

- A. State Agency Alternative Fuels Activities
- B. Alternative Fuel Initiatives in Other States
- C. Fleets and Biofuels Users in Tennessee
- C. Biofuels Resources
- D. References

## Appendix A

### State Agency Alternative Fuel Activities

#### Tennessee Department of Agriculture

##### Agribusiness Development

Tennessee is home to one ethanol production facility owned by Tate and Lyle, located in Loudon County. This facility has current annual production capacity of 67 million gallons. Most of this product is shipped out of state.

There are several ethanol and biodiesel facilities being proposed or in various stages of planning and construction. In particular, a large ethanol plant being planned in Obion County has received a USDA Rural Development Grant to assist with construction. Tennessee Bioenergy Inc. recently received a USDA grant to help construct a biodiesel production plant in Coffee County. AgriEnergy Management (AEM), a new biodiesel production facility under construction in Marshall County, has a planned annual production of 140 million gallons once the facility is completed.

##### Regulatory Services

The Tennessee Department of Agriculture is charged with enforcement of the Tennessee Kerosene and Motor Fuels Quality Inspection Act of 1989, TCA 47-18-1301, *et seq.* Rules pursuant to this act are presented in the Rules and Regulations of the State of Tennessee, Chapter 0080-5-12. TCA 47-18-1304 stipulates that motor fuels conveyed in Tennessee shall (1) be properly labeled according to federal and state standards, (2) shall meet the standards established in the annual book of ASTM standards, (3) provides that the department may adopt alternative volatility standards for gasoline-alcohol blends, and (4) adopts any federal law in conflict with ASTM standards.

##### Current issues from a regulatory perspective

##### Denatured Fuel Ethanol

The Department of Agriculture has adopted ASTM D 4806, "Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel" as the state standard for denatured fuel ethanol.

There have been recent reports for both oil companies and the automotive industry of failures in both fuel dispensing equipment and vehicles that have been attributed to sulfates in fuel ethanol. The current ASTM specification does not address sulfates. ASTM has recently balloted two versions of sulfate control to be incorporated into ASTM D 4806; a 1 ppm limit and a 4 ppm limit were both balloted, and both received negative votes that must be addressed before the ballot can proceed toward a standard. Until the sulfate issue is resolved, this remains a potential issue for denatured ethanol and ethanol blended fuels.



## **Alternative Fuels and Tennessee**

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### **10 Percent Ethanol Blends**

The addition of ethanol to gasoline will affect both the vapor pressure and the distillation temperatures of the base fuel. Based on the authority granted in TCA 47-18-1304, the department has promulgated rules that provide for a 1 psi tolerance for ethanol blended fuels as well as a 12 degrees F. tolerance on the 50 volume percent distillation temperature.

Because ethanol is miscible with water, great care must be exercised by marketers in the transportation and storage of 10 percent ethanol blends. Storage tanks typically have some measurable amount of water in the tank bottoms. This water can act as a magnet on the ethanol portion of the blend, pulling the ethanol to the bottom of the tank and resulting in an ethanol-deficient layer at the top and an ethanol-rich layer at the bottom. This process is called phase separation.

Another issue that currently exists with 10 percent ethanol blends in Tennessee is due to the fact that a substantial portion of our fuel continues to contain MTBE, methyl tertiary butyl ether. MTBE, like ethanol, is an oxygenated compound. When gasoline that contains MTBE is blended with ethanol, the resulting mixture may exceed the federally controlled limit on the total mass percent oxygen that is allowed in automotive gasoline. The Department of Agriculture has found this situation a number of times in the past year. This performance requirement is important because too much oxygen can cause fuel leaning and lead to mechanical problems, the extent depending on the vehicle's calibration.

### **85 Percent Ethanol Blends**

The Department of Agriculture has adopted ASTM D 5798, "Standard Specification for Fuel Ethanol (Ed75-Ed85) for Automotive Spark-Ignition Engines" as the state standard for E85 Fuel Ethanol. We are not aware of any significant issues associated with this fuel at the moment, but we continue to monitor changes in the ASTM standard.

### **Biodiesel B100**

The Department of Agriculture has adopted ASTM D 6751 "Standard Specification for Biodiesel Fuel (B100) Blend Stock for Distillate Fuels" as the state standard for B100 blend stock.

Although a specification for B100 has been developed, there are issues that continue to be addressed within ASTM, most notably being concerns with oxidative stability of the fuel. Fuels with poor oxidation stability can lead to high acid numbers, high viscosity and the formation of gums and sediments. ASTM is working on a consensus limit and test method that will control oxidation stability. Until then, fuels that are certified to meet ASTM standards may not have sufficient stability for long-term storage. When the fuel is used within 2-4 months, B100 is not typically a problem.

Additionally, the solvent effect of the methyl esters in biodiesel can loosen deposits in the fuel tanks and clog filters in vehicles that have been historically run on diesel fuel. After a few filter changes, this problem corrects itself. In some cases the sediments can cause the filter to burst and the deposits will go into the injector system, possibly causing injector deposits and even injector failures. This effect is greatest on blends of 35 percent up to B100, compared with B20 and lower blends. This will not be a problem for new vehicles that have always used biodiesel.

Material compatibility may be an issue with B100, as the product may degrade or seep through certain hoses and gaskets. This is most likely on engines manufactured prior to 1993. There have not been significant material compatibility problems with blends of B20 or lower.

### **Biodiesel B20**

There are no requirements currently adopted by ASTM or the state of Tennessee for B20, other than rules that state that the diesel fuel must meet the D 975 specification and the B100 must meet the D 6751 requirements. ASTM is very close to having a standard for B20. The current issue that is being debated is the stability concern discussed above in B100. Until the stability issue is resolved, it is unlikely that ASTM will adopt the B20 specifications. Stability may be resolved within the next six months, so there is a strong possibility that the B20 specifications could be approved at the June 2006 ASTM Committee D 02 meeting. However, it may be prudent for the state to adopt interim rules for B20 before the ASTM specification becomes available. Adoption of a standard will provide some degree of protection and confirm the legitimate place of the fuel in the market.

Cold flow properties of B20 must also be monitored closely to ensure filters do not plug in cold weather. B20 is generally blended with diesel fuel that has been treated with cold flow additives that will help lower the temperature at which filters plug. However, additive manufacturers have not achieved a successful additive that will enhance the cold flow properties of the B100 itself, due mainly to the variability in the composition of minor compounds that may affect the performance of the cold flow improvers. Therefore, it is essential that B20 be tested for cold flow performance properties.

Another performance issue with blended products is that there are no established ASTM test methods to accurately determine the percent biodiesel in a blend. However, there are methods in use that predict the blends very well, and ASTM will likely be balloting a new method within the next six months.

### **Biodiesel B5**

There are no requirements currently adopted by ASTM or the state of Tennessee for B5 or lower blends, other than rules that state that the diesel fuel must meet the D 975 specification and the B100 must meet the D 6751 requirements. The issues discussed above are greatly reduced with B5 blends and below. In fact, it is generally understood that B5 and lower blends will not have a stand-alone specification and will be required to meet the requirements of D 975 diesel fuel.

### **Labeling Requirements for Biodiesel**

Tennessee rules do not currently have labeling requirements for biodiesel. However, the National Conference on Weights and Measures (NCWM) adopted revisions to the model engine fuel regulation at the July 2005 Annual Meeting that included labeling requirements for biodiesel. The Department of Agriculture will adopt those guidelines as rule with the next revision of Rule 0080-5-12.

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The following was adopted by the NCWM pursuant to biodiesel labeling:

*Identification of Product. - Biodiesel and biodiesel blends shall be identified by the capital letter B followed by the numerical value representing the volume percentage of biodiesel fuel. (Examples: B10; B20; B100)*

*Labeling of Retail Dispensers Containing Between 5% and 20% Biodiesel. - Each retail dispenser of biodiesel blend containing more than 5% and up to and including 20% biodiesel shall be labeled with either:*

*The capital letter B followed by the numerical value representing the volume percentage of biodiesel fuel and ending with "biodiesel blend." (Examples: B10 biodiesel blend; B20 biodiesel blend), or;*

*The phrase "biodiesel blend between 5% and 20%" or similar words.*

*Labeling of Retail Dispensers Containing More Than 20% Biodiesel. - Each retail dispenser of biodiesel or biodiesel blend containing more than 20% biodiesel shall be labeled with the capital letter B followed by the numerical value representing the volume percentage of biodiesel fuel and ending with either "biodiesel" or "biodiesel blend." (Examples: B100 biodiesel; B60 biodiesel blend).*

*Documentation for Dispenser Labeling Purposes. - The retailer shall be provided, at the time of delivery of the fuel, with a declaration of the volume percent biodiesel on an invoice, bill of lading, shipping paper, or other document. This documentation is for dispenser labeling purposes only; it is the responsibility of any potential blender to determine the amount of biodiesel in the diesel fuel prior to blending.*

*Exemption. - Biodiesel blends containing 5% or less biodiesel by volume are exempted from the requirements of Section 3.15.*

### **General Biodiesel Blend Considerations**

Based on vehicle warranty information, the prudence of permitting blends greater than 20 percent be sold to retail customers at public dispensing facilities should be examined. The key to this is “public dispensing facilities” as opposed to contractual sales to fleet operators or farmers.

### **Tennessee Department of Economic and Community Development**

#### **ECD Energy Division Grant Funding Support of Alternative Fuel Development and Use**

The **Clean Cities Program** is sponsored by the U.S. Department of Energy and was created to advance the use of cars and trucks powered by alternative fuels. The program promotes the purchase of alternative fuel vehicles and the expansion of the AFV refueling infrastructure. These programs have received a combination of federal funds through the State Energy Office.

The program initiatives include three locations. The East Tennessee Clean Fuels Coalition (ETCFC) located in Knoxville received administrative start-up funds and follow-up Special Project grants. Clean Cities of Middle Tennessee (CCMT) located in Nashville was granted administrative start-up funds and additional grants the following two years to sustain this coalition. Both organizations have been officially designated by the DOE as Clean Cities under the federal program.

CCMT also provided assistance in getting the West Tennessee Clean Cities Coalition started. The West Tennessee Clean Cities Coalition (WTCCC) has been granted administrative start-up funds for this coalition.

The City of Franklin, through a grant written by the CCMT, has received a special project grant for \$200,000 to assist in the purchase of a hybrid heavy duty-diesel vehicle for the Franklin Transit Authority. This transit bus runs on electricity and biodiesel (B20).

Tennessee State University through a special project grant with the DOE received \$73,235 to establish biomass information network supporting workshops and interactions among Tennessee agribusiness for development and marketing of bioproduct feedstocks.

The Southeastern Regional Biomass Energy Program provided a grant for public information workshops and media materials to a middle Tennessee non-profit agency providing operating support for the Tennessee Clean Cities.

#### **Biodiesel Infrastructure Program**

The Energy Division of ECD has recently instituted a grant program for Tennessee counties to provide infrastructure for the use of biodiesel fuel for school buses, maintenance vehicles, heavy equipment or any diesel-powered vehicles. The program provides grants for up to \$12,000 for each of the 95 counties for the purchase and installation of biodiesel tanks, pumps and card readers to be installed and used for biodiesel fueling in those communities. The total funding available in this grant program is \$1,140,000. Funds are not available under this grant to purchase biodiesel fuel.

The total federal program funds through ECD, Energy Division applied for alternative fuel development and use to date: \$1,953,627.

### Tennessee Department of Environment and Conservation

#### Education and Outreach

Biofuels activities at TDEC mostly involve the promotion of alternative fuels as an environmentally sound fuel choice, and the education of the public through regularly scheduled outreach activities like Earth Day, Clean Air Month and other outreach opportunities. Additionally, TDEC is an active participant in the Southeast Alternative Fuels Task Force (SEAF TF).

TDEC has practical and useful information on our Clean Air Tennessee website ([www.cleanairtn.org](http://www.cleanairtn.org)) for individuals and businesses that are looking for ways to make a positive impact on air quality.

#### Regional Biofuels Efforts

Tennessee has a contingency of alternative fuel advocates. Coordinating in part through the SEAF TF, these advocates, including TDEC, are attempting to promote the availability and use of alternative fuels. The ultimate goal through the SEAF TF is to establish continuous corridors of alternative fuels along interstates traversing the Southeast. At this time, the focus of the SEAF TF is on biodiesel and ethanol. With a focused outreach and strategic vision, the SEAF TF is attempting to build unity and leverage available resources and experience. Building momentum is slow, but growing. We are currently faced with a unique opportunity for the advancement of alternative fuels, given air quality issues and current petroleum prices and supplies.

In June 2005, TDEC hosted a regional biofuels workshop in Gatlinburg in conjunction with the SEAF TF. The workshop focused on providing information on the advantages of biofuels to stakeholders, fuel providers and marketers, and public and private fleets as well as the general public.

#### Biofuels Use

TDEC management encourages its employees to fuel flexible fuel vehicles with E85 at the downtown Citgo station.

Panther Creek State Park is the first state park to pilot use of biodiesel. Panther Creek has had positive experiences using B20 this past summer. As opportunity allows, TDEC hopes to expand biodiesel use to other state parks.

#### Supplemental Environmental Projects

As part of enforcement settlements, TDEC has allowed violators of the Tennessee Air Quality Act to perform supplemental environmental projects (SEPs) in lieu of paying monetary civil penalties. Recent SEPs have supplied biodiesel fuel for use at state parks in East Tennessee.

#### Tennessee Air Pollution Control Board

The Tennessee Air Pollution Control Board issued a board order in 2005 to encourage the development of a work group to study ways to reduce diesel emissions from mobile sources, including the use of cleaner, renewable fuels.

### Tennessee Department of General Services

#### Current Program

The federal Energy Policy Act of 1992 requires fleets operated by state governments and alternative fuel providers to acquire a certain percentage of alternative fuel vehicles each year to promote the use of non-petroleum fuels to reduce U.S. dependence on imported oil. The regulations focus on building an inventory of alternative fuel vehicles in large light-duty fleets in large metropolitan areas. The requirement applies to metropolitan areas with a population of 250,000 or more, which includes the Tennessee counties of Davidson, Hamilton, Knox and Shelby, and the Tri-Cities area including Sullivan and Washington counties. Beginning with model year 1997 vehicles, the percentage of new light-duty vehicle purchases that must now be alternative fuel vehicles is 75 percent for state fleets.

There are currently 810 alternative fueled vehicles in the Motor Vehicle Management Fleet. During 2005, the department purchased 218 flexible fuel vehicles and four hybrid-electric vehicles. We estimate that an additional 75 units will be replaced with alternative fueled vehicles for FY-05/06 to meet the 75 percent federal mandate. Generally, Motor Vehicle Management exceeds the 75 percent mandate by 5 percent to 10 percent to gain alternative fuel credits for the state of Tennessee.

The vehicles purchased by Motor Vehicle Management are flexible fuel vehicles that operate on either unleaded gasoline or E85 (ethanol). The current makes and models being utilized in the fleet are sedans (Ford Taurus, Dodge Stratus), minivans (Dodge Caravan), trucks (Chevrolet ½ ton 4X2 and 4X4) and SUVs (Ford Explorer, Chevrolet Tahoe).

#### Vehicle Cost

The additional cost of FFV vehicles is approximately \$1,200 to \$1,500 dollars more than a regular gasoline vehicle of the same type.

#### E85 Fuel Cost

Based on the limited number of suppliers and the lack of fueling infrastructure, E85 fuel prices are currently higher than regular unleaded gasoline. For example, for week 47, the contract pricing (Fuelman) was \$2.05 per gallon for E85 and \$1.67 per gallon for regular unleaded gasoline, cost difference of .38 cents per gallon. This was billing cost to Motor Vehicle Management for week 47, November 21, 2005 through November 27, 2005.

#### E85 Fuel Sites

There has been only one E85 fuel site in the state that handles this type of fuel (Nashville Citgo Station at Spring Street and Main). A new E85 site has just opened in Clarksville in Montgomery County.

## **Alternative Fuels and Tennessee**

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### **Biodiesel**

Currently Motor Vehicle Management has user agencies using biodiesel fuel in the East Tennessee area. This is a pilot program that Motor Vehicle Management has identified vehicles in the Department of Correction, Agriculture and State Parks to test biodiesel.

### **Biodiesel Cost**

Once again based on the limited number of suppliers and the lack of fueling infrastructure, the cost of biodiesel is higher than regular diesel fuel. The contract pricing (Fuelman) for week 47 for biodiesel was \$2.36 per gallon in Johnson City and \$2.33 in Knoxville. The cost of regular diesel was \$1.88 per gallon in Johnson City and \$1.91 per gallon in Knoxville. This is a cost difference of \$0.48 cents and \$0.42 cents, respectively.

### **Biodiesel Fuel Sites**

Currently the Department of Transportation's Regional Garages in Johnson City and Knoxville have biodiesel available to be used in state-owned vehicles and equipment. Also, Panther Creek State Park has on-site biodiesel that they are using in state-owned vehicles and equipment.

### **Recommendation**

It is possible that the following locations could handle biodiesel to fuel state-owned vehicles and equipment. TDOT has 23 fuel sites across the state, State Parks has 50 fuel site locations, Department of Correction has 12 fuel site locations, and the Department of Mental Health has 7 locations, not counting some of the smaller fuel sites that would be available.

Focusing outside of state government, look at local county and city governments. A lot of these counties have already have fuel sites for school buses and highway maintenance vehicles and equipment. If they could receive any type of grant money to offset the higher fuel cost this would be a great effort in gaining support for alternative fuels.

The state of Tennessee should be working with major suppliers of these fuels to turn the market prices to a lower cost that would be more compatible with other petroleum products.

### **Major Concern**

Motor Vehicle Management has a concern on how biodiesel will affect vehicle and equipment warranty and additional maintenance cost to run this type fuel.

### Tennessee Department of Transportation

#### **TDOT's Role in Alternative Fuels**

As the state transportation agency, TDOT's role is to support and encourage the use of alternative fuels as a key strategy in achieving cleaner transportation in Tennessee. During the development of TDOT's long-range transportation plan, each of the regional steering committees recommended that TDOT promote the use of alternative fuels.

A related issue is the large contribution of mobile sources (cars, SUVs, buses and trucks) to Tennessee's air quality problems. Increasing the use of alternative fuels is a major control measure for reducing mobile source emissions in the state. TDOT also administers the Congestion Mitigation and Air Quality Improvement (CMAQ) program in Tennessee, the largest funding source for mobile source emission reduction programs, including alternative fuels.

#### **TDOT biodiesel pilot project in East Tennessee**

The state's new fuel contract, which became effective in September 2005, allows state agencies to purchase a B20 blend of biodiesel as well as E85.

In November 2005, TDOT began a pilot to use B20 in on-road diesel vehicles at three East Tennessee refueling sites—the TDOT Region garage and the District 15 Maintenance garage in Knoxville and the District 11 garage in Johnson City. This is the first widespread use of biodiesel in state vehicles. The TDOT B20 pilot includes:

- ♦ 99 on-road diesel vehicles located in Knoxville, including HELP trucks
- ♦ 34 on-road diesel vehicles in Johnson City
- ♦ Virgin soy biodiesel

Depending upon the outcome of this pilot, TDOT will consider extending the use of B20 to off-road equipment in the region and expanding B20 use to other TDOT regions. The department will also continue to work with the Department of General Services to encourage the use of biodiesel at other state facilities with centrally fueled fleets.

#### **Alternative fuels infrastructure—CMAQ project and SB 2061**

To encourage and expand the use of cleaner burning biodiesel (B20) and ethanol (E85), TDOT will work with retail fuel providers to establish a statewide network of publicly accessible biofuels refueling stations. TDOT will help retail fuel stations pay the capital costs of preparing or installing fuel storage tanks and fuel pumps for B20 and/or E85.

To accomplish this, TDOT will leverage available funding from two sources. The first is an Alternative Fuels Infrastructure project funded under the CMAQ program. The second funding source is authorized by SB 2061, passed by the Tennessee General Assembly in 2005. This bill earmarked \$60,000 of TDOT's general revenue for the purpose of installing alternative fuel infrastructure. These funds will pay up to 80 percent of the infrastructure costs, with the remaining 20 percent to be provided as match by participating fuel stations.

SB 2061 by Senator McLeary authorizes TDOT to enter into public-private partnerships with transportation fuel providers, including farmer co-ops, to install a network of biofuel refueling facilities. It also authorizes the department to establish a grant program to provide financial assistance to help pay the capital costs of purchasing, preparing and installing biofuel storage



## Alternative Fuels and Tennessee

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tanks and pumps at private sector fuel stations. It further provides that the department try to secure federal assistance and other funding for the grant program and attempt to maximize the total investment in biofuel refueling facilities.

### Budget for Alternative Fuels Infrastructure

CMAQ funds	\$240,000
State funds (SB 2061)	60,000
Retail station match	<u>75,000</u>
Total	\$375,000

Early in 2006, TDOT expects to begin an open selection process to identify partner stations in areas where reasonably accessible and convenient privately owned biofuels fueling stations do not exist. The Tennessee Oil Marketers Association and the Tennessee Farmers Cooperative Association will assist in publicizing the opportunity to fuel distributors across the state. To help these refueling stations grow the market for E85 and B20, TDOT will encourage fleet owners and citizens to use biofuels by collaborating with ongoing programs, including Clean Cities Coalitions, regional clean air partnerships and the Southeast Alternative Fuels Task Force.

### **Biodiesel grant to Metro Transit Authority in Nashville**

TDOT's Public Transportation, Waterways and Rail Division provided a \$100,000 grant to Metro Transit Authority (MTA) for a pilot project that involved using biodiesel in 18 transit buses. MTA views the pilot as a complete success and would like to expand the use of biodiesel to the entire transit fleet.

### **Purchase of Flexible Fuel Vehicles and Use of Biodiesel**

Almost 52 percent of the TDOT light-duty fleet consists of flexible fuel vehicles capable of burning E85. These 718 flexible fuel vehicles are located primarily in urban areas of the state. The department plans to obtain additional alternative fuel credits under the Energy Policy Act (EPA Act) for the use of biodiesel in heavy-duty diesel vehicles. One credit may be earned for every 2,250 gallons of B20 (equivalent to 450 gallons of B100) used in on-road heavy-duty diesel vehicles in a calendar year. Biodiesel credits may not comprise more than half of the alternative fuel credits claimed each year.

### **Participation in Southeast Alternative Fuels Task Force**

TDOT is an active participant in the Southeast Alternative Fuels Task Force, [www.sealtfuels.org](http://www.sealtfuels.org), a broad-based partnership of stakeholders committed to increase the availability and use of alternative fuels in the Southeast. The Task Force includes representatives from state and federal environmental, energy and transportation agencies, Clean Cities Coalitions, fuel suppliers and marketers, fleet managers, and other interested partners. This effort originated and currently operates in the states of Georgia, North Carolina, South Carolina and Tennessee. Task Force participants are working together to establish a network of publicly accessible refueling stations for E85 and B20 along interstate corridors. The goal is to allow a traveler to reach major destinations across the Southeast using these clean, domestic renewable fuels. Alan Jones is co-chair of the Task Force Steering Committee.

## Appendix B

### Alternative Fuel Initiatives in Other States

#### I. State Agency Use of Alternative Fuels

##### B20 Use by North Carolina DOT

In 1997, the North Carolina Department of Transportation (NCDOT) began using B20 as a test and evaluation pilot program in Winston-Salem. The state now boasts 22 biodiesel fueling stations in 20 counties scattered throughout the state. Most of these sites also dispense other alternative fuels, including E85, propane and compressed natural gas.

North Carolina's most common use of biodiesel is in heavy-duty trucks operated by the state DOT. The agency operates approximately 11,500 vehicles, of which 8,250 are on-road and 3,250 are off-road vehicles. Roughly half of DOT's vehicles are diesel-powered. Many of the vehicles use B20 all the time, and approximately 25 percent use B20 at least some of the time. In 2004, North Carolina state fleets consumed more than 260,000 gallons of B100.

NCDOT reports that use of B20 has caused no problems in the engines or fuel systems of DOT vehicles, and vehicles perform with no loss of performance in terms of power or longevity.

#### II. Alternative Fuel Use Mandates for State Fleets

##### North Carolina Alternative Fuel Use and Fuel Efficient Vehicle Requirements

By January 1, 2006, state-owned vehicle fleets with more than 10 motor vehicles designed for highway use must develop and implement plans to improve the use of alternative fuels and efficient vehicles. The plans must enable state-owned fleets to achieve a 20 percent reduction or displacement of the current petroleum products consumed by January 1, 2010. Reductions may be met by petroleum or oils displaced through the use of biodiesel, ethanol, synthetic oils or lubricants; other alternative fuels; hybrid-electric vehicles; other fuel-efficient or low-emission vehicles; or additional methods as may be approved by the State Energy Office (reference Senate Bill 622 and North Carolina 2005 State Budget 19.5).

##### Iowa Executive Order

A 2005 executive order requires all state agencies to purchase bulk diesel fuel that contains at least 5 percent renewable content by 2007, rising to 20 percent renewable content by 2010. Agencies must ensure that diesel vehicles operate on biodiesel blends whenever the blends are available.

##### New York Executive Order

In November 2005, Governor Pataki issued an executive order that requires all state agencies and public authorities to increase their purchase and use of biofuels for heating facilities and fueling vehicles. The order mandates that by 2007, biodiesel must supply 2 percent of the fuel used in the state fleet, increasing to 10 percent by 2012.

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### *New Mexico Executive Order*

In September 2005, Governor Bill Richardson signed an executive order requiring cabinet-level state agencies, public schools and institutions of higher education to meet 15 percent of their transportation fuel needs with ethanol or biodiesel by 2010. The order also requires those agencies and schools to buy alternative fuel or hybrid vehicles for 75 percent of their vehicle purchases each year.

### **III. Vehicle Purchase Requirements**

#### *North Carolina Alternative Fuel Vehicle (AFV) Acquisition Requirements*

On and after January 1, 2004, at least 75 percent of new or replacement light-duty cars and trucks (8,500 pounds or less Gross Vehicle Weight Rating) purchased by the state must be alternative fuel vehicles or low emission vehicles (reference North Carolina General Statutes 143-215.107C).

#### *Iowa Executive Order*

A 2005 executive order requires that all state agency non-law enforcement, light-duty vehicles procured by 2010 must be alternative fuel vehicles or hybrid-electric vehicles (HEV) when an equivalent AFV or HEV is available. Agencies must also ensure that their flexible fuel vehicles operate on E85 whenever an E85 refueling facility is available.

### **IV. Fuel Supply Mandates**

#### *Minnesota Mandate of B2 Biodiesel Blend for All Diesel Fuel in State*

In 2002, the Minnesota legislature passed a law requiring that diesel fuel sold in the state must contain at least 2 percent biodiesel (B2) effective September 29, 2005. There are a few exceptions to the requirement, including railroad locomotives, off-road mining equipment and heating equipment motors located at nuclear power plants.

Minnesota believes that biodiesel will provide significant economic benefits to the state through reduced reliance on imported oil and increased demand for Minnesota-grown soybeans. It will also benefit the state's natural resources and public health by reducing harmful vehicle emissions. In the fall 2005, with three new production facilities, Minnesota is the largest producer of biodiesel in the nation. It is estimated that the B2 requirement for Minnesota will replace 16 million gallons of diesel fuel with domestic, renewable biodiesel.

### **V. State Tax Credits**

#### *North Carolina Renewable Energy Property Tax Credit*

Taxpayers who construct, purchase or lease renewable energy properties are eligible for a tax credit equal to 35 percent of the cost of the property. Renewable energy property includes equipment that uses renewable biomass resources to produce ethanol, methanol, biodiesel or methane produced via anaerobic biogas utilizing agricultural and animal waste or garbage, and related devices for converting, conditioning, and storing the liquid fuels and gas produced with biomass equipment. The credit must be taken in five equal installments beginning with the

taxable year in which the property is placed in service. A ceiling of \$2.5 million per installation applies to renewable energy property placed in service for any purpose other than residential. Property must be placed in service before January 1, 2011 (reference Senate Bill 1149, 2005 and North Carolina General Statutes 105-129.15 and 105-129.16A).

### North Carolina Alternative Fuel Refueling Infrastructure Tax Credit

A tax credit is available for qualified refueling facilities that dispense biodiesel, 100 percent ethanol or ethanol/gasoline mixtures consisting of at least 70 percent ethanol. The credit is equal to 15 percent of the cost to the taxpayer of constructing and installing the part of the dispensing facility, including pumps, storage tanks and related equipment, that is directly and exclusively used for dispensing or storing the fuel. The credit must be taken in three equal annual installments beginning with the taxable year in which the facility is placed in service. Facilities must be placed in service before January 1, 2008 (reference North Carolina General Statutes 105 129.16D).

### North Carolina Alternative Fuel Refueling Infrastructure Tax Credit

A tax credit is available for the production or processing of biodiesel, 100 percent ethanol or ethanol/gasoline mixtures consisting of at least 70 percent ethanol. The credit is equal to 25 percent of the cost of constructing and equipping the facility. The credit must be taken in seven equal annual installments beginning with the taxable year in which the facility is placed in service. Facilities must be placed in service before January 1, 2008 (reference North Carolina General Statutes 105 129.16D).

## **VI. Alternative Fuel Tax Exemptions and Reductions**

### North Carolina Alternative Fuel Tax Exemption

The retail sale, use, storage or consumption of alternative fuels is exempt from the state retail sales and use tax (reference North Carolina General Statutes 105-164.13).

### Iowa Lowers Sale Tax on Ethanol

Beginning January 1, 2006, Iowa taxes E85 at a reduced rate of \$0.17 per gallon, as compared to the conventional gasoline tax rate of \$0.203 per gallon. This tax incentive expires June 2007.

## **VII. Grants and Innovative Funding Programs**

### North Carolina Alternative Fuel Vehicle (AFV) Grants

Grants from the Department of Environment and Natural Resources, Division of Air Quality, are available for the incremental cost of purchasing Original Equipment Manufacturer (OEM) alternative fuel vehicles, vehicle conversions and constructing or implementing alternative fuel public refueling facilities. More than \$500,000 in funding is available.

### North Carolina Alternative Fuel and Alternative Fuel Vehicle (AFV) Fund

The State Energy Office administers an energy credit banking program which enables the state to generate funds from the sale of Energy Policy Act of 1992 (EPAct) credits. The money generated by the sale of EPAct credits is deposited into the Alternative Fuel Revolving Fund, which

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enables state agencies to offset the costs of alternative fuel, related refueling infrastructure and alternative fuel vehicles. Funds are distributed to state departments, institutions and agencies in proportion to the number of EPA credits generated by each. For the purpose of this program, alternative fuel includes biodiesel (minimum of B20), ethanol (minimum of E85), compressed natural gas, propane and electricity. The fund also covers additional projects approved by the Energy Policy Council (reference Senate Bill 1149, 2005 and North Carolina General Statutes 143-58.4, 143-58.5, 136-28.13, and 143-341(8)(i).

### *Iowa Ethanol Infrastructure Cost-Share Program*

This program will provide \$325,000 annually for 2005 through 2008 for installing or converting E85 refueling infrastructure and establishing terminal facilities to store biodiesel. This funding is expected to add at least 30 new or converted E85 retail outlets and four new or converted terminal facilities.

### *Iowa Alternate Energy Revolving Loan Program*

Iowa's Alternate Energy Revolving Loan Program offers zero-percent loans for up to half the cost of biomass or alternative fuel production projects. These loans can be up to a maximum of \$250,000 per facility.

### *Iowa Renewable Fuels Fund's Value-Added Agricultural Products and Processes Financial Assistance Program*

This program offers forgivable and traditional low-interest loans for projects based on biomass and alternative fuel technologies. About 20 percent of the money awarded to a project is in the form of a forgivable loan, and the other 80 percent is a low-interest loan.

## Appendix C

### Partial List of Fleets and Biofuels Users in Tennessee

Through December 2005

Alcoa, Inc.	Athens Utility Board
BAE Systems	Big South Fork National River/ Recreation Area
Blount Co. Highway Dept.	Chattanooga Area Reg., Transportation Auth.
City of Alcoa	City of Athens
City of Bristol	City of Chattanooga
City of Cleveland	City of Gatlinburg
City of Knoxville	City of Maryville
City of Sevierville	Cortese Tree Specialists
Crabtree Farms	Eastman
Franklin Transit Authority	Great Smoky Mountains NP
Hallsdale-Powell Utility District	Hamilton County Highway Dept.
Hawkins County EMS	Ijams Nature Center
Jackson Transit Authority	Knox County
Knoxville Area Transit	Knoxville Utilities Board
Mayfield Dairy Farms	MDM Trucking
McCallie School	McNutt Oil
Meigs County Highway Department	Memphis Area Transit Agency
Metropolitan Knoxville Airport Authority	Middle Tennessee State University
Nashville Electric Service	Oak Ridge National Lab/ DOE (3 refueling sites)
Panther Creek State Park	Panther Energy, Jackson
Sequatchie Valley Institute	Sevier County Utility District
Stafford Bus Service	Tennessee Department of Transportation
TransTech Volvo/BMW	University of Tennessee at Knoxville

### Appendix D

#### Biofuels Resources

**National Biodiesel Board**

[www.biodiesel.org](http://www.biodiesel.org)

**National Ethanol Vehicle Coalition**

[www.e85fuel.com](http://www.e85fuel.com)

**U.S. Environmental Protection Agency**

Alternative Fuels

[www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm#fact](http://www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm#fact)

**U.S. Department of Energy**

Alternative Fuels Data Center

[www.eere.energy.gov/afdc/](http://www.eere.energy.gov/afdc/)

**U.S. Department of Energy**

Environmental Policy Act (EPAAct)

<http://www.eere.energy.gov/vehiclesandfuels/epact/index.shtml>

**Renewable Fuels Association**

[www.ethanolrfa.org/](http://www.ethanolrfa.org/)

**Governors' Ethanol Coalition**

<http://www.ethanol-gec.org/>

**Tennessee State University, Biomass Information Network**

<http://www.tennesseebiomass.com/aboutus.php>

**Tennessee UT Center for Profitable Agriculture program**

<http://cpa.utk.edu/level2/projecthighlights/projhigh-2.htm>

**Oak Ridge National Laboratory offers online assistance**

<http://bioenergy.ornl.gov/>

**DOE Regional Biomass** (and liquid fuels) program has this website for occasional grants and announcements of federal DOE opportunities and technical assistance  
(Tennessee contact: Brian Hensley, State Energy Division)

<http://www.serbep.org/>

**DOE and USDA "Federal Purchasing of Bioproducts"** guideline as a component of an overall agriculture program that will strengthen a biobased economy, improving profitability of biobased fuels. USDA Farm Bill, Section 9006, provides renewable energy support for alternative fuel production and use; Nashville contact: Will Dodson 783-1350.

[http://www.rurdev.usda.gov/rbs/farmbill/what\\_is.html](http://www.rurdev.usda.gov/rbs/farmbill/what_is.html)

## Appendix E

### References

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- <sup>v</sup> American Petroleum Institute, *Why We Need A National Energy Strategy*, <http://api-ec.api.org/policy/index>, accessed January 10, 2006.
- <sup>vi</sup> U.S. DOE, Energy Information Administration, *Short-Term Energy Outlook*, January 10, 2006, [www.eia.doe.gov/emeu/steo/pub/contents.html](http://www.eia.doe.gov/emeu/steo/pub/contents.html).
- <sup>vii</sup> U.S. DOE, Energy Information Administration, *Prime Supplier Sales Volumes*, 2004.
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- <sup>xi</sup> Renewable Fuels Association press release, *U.S. Ethanol Industry Continues Tremendous Growth, October Production Sets Yet Another New Record*, December 22, 2005.
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- <sup>xiii</sup> National Biodiesel Board, *U.S. Biodiesel Production Capacity*, [www.biodiesel.org](http://www.biodiesel.org), accessed January 10, 2006.
- <sup>xiv</sup> National Biodiesel Board, *Standards and Warranties*, [www.biodiesel.org](http://www.biodiesel.org), accessed January 10, 2006.